# 9. Agricultural Archæology

In view of former owners' prominence in nineteenth-century scientific agriculture organizations, project-area fields were deemed to be a proper laboratory for examining the potential for archæological study of agricultural practices.

"Book farmers," as they sometimes were derisively called, introduced many new agricultural practices during the nineteenth century. Farm periodicals were required reading for these people, who were quick to experiment with the latest technique for increasing fertility.

Best sellers included scientific volumes like Edmund Ruffin's *Essay on Calcareous Manures* of 1832, or monthly periodicals like the *Albany Cultivator* or the *American Farmer*, which were eagerly read and discussed at agricultural society meetings (Scharf 1888:436; Anderson 1967).

Agricultural periodicals helped bring technology and popular culture to the farmer along with ideas about farming practice. The *American Agriculturist* for 1866 contained an article entitled "How to Play Base Ball" as well as a two-part article on making field drain tiles.

John Hare Powel, secretary of the Pennsylvania Agricultural Society, proclaimed in 1824 that "Science is essential to the agricultural art — chemistry aids it at every turn — cooking is a chemical process..." (Pennsylvania Agricultural Society 1824: 259).

In Delaware, where the land had suffered badly, some book farmers were spectacularly successful and some became spectacularly wealthy. A considerable portion of the profits generated by agricultural improvement was invested in internal improvements, which in turn produced yet more wealth. By the middle of the nineteenth century, progressive farmers had changed much of the state's landscape.

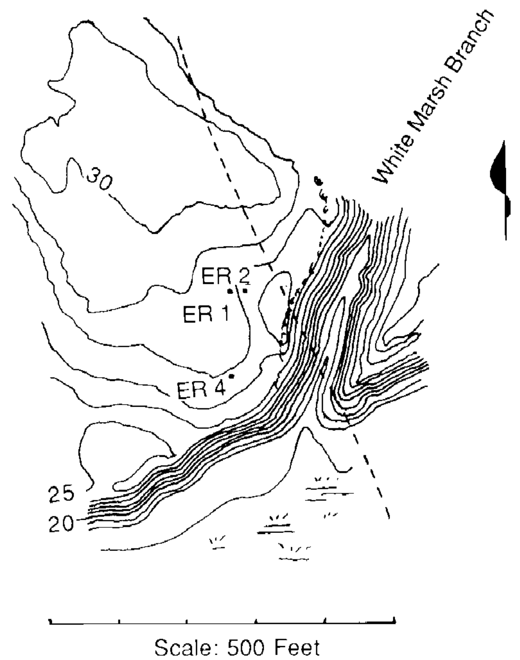
The list of Delaware subscribers to Henry Colman's *Agriculture and Rural Economy*, 1844, is a roster of the upstate "book farmers" soon after the beginning of the agricultural revolution:

Wilson and Heald, Wilmington
Benjamin Webb, Wilmington
James W. Thompson, M. D., Wilmington
Samuel Canby, Wilmington
Edward Tatnall, Wilmington
John Andrews, Wilmington
James Webb, Wilmington
John Jones, Wilmington
Joseph Carr, Wilmington
Caleb Churchman, Wilmington
Bryan Jackson, Wilmington
J. S. H. Boiles, Wilmington
James T. Bird, Wilmington
Henry duPont, Wilmington
Edward C. Hewes, Wilmington
Anthony Biddeman, Wilmington
C. J. duPont, Wilmington
Chauncey P. Holcomb, New Castle
John B. Le Fever, New Castle
John W. Andrews, Stockford
Edward T. Bellah, Brandywine
William S. Boulden, Newport

Scientific farmers quite frequently were the best educated and most progressive citizens, leaders in other fields as well. Industrialists are found on any list of agriculture society membership, together with physicians and political leaders.

The Delaware Rail Road Company, for example, was dominated by such progressive farmers as Manlove Hayes, Henry M. Ridgely, and Charles I. duPont, all of whom owned farms near the project area. It was no mere coincidence that the secretary of the railroad company was simultaneously the secretary of the state board of agriculture (Scharf 1888:431).

While many agriculture-related, or "agribusiness," sites have been excavated, the fields themselves have received little attention in the literature of American archæology.



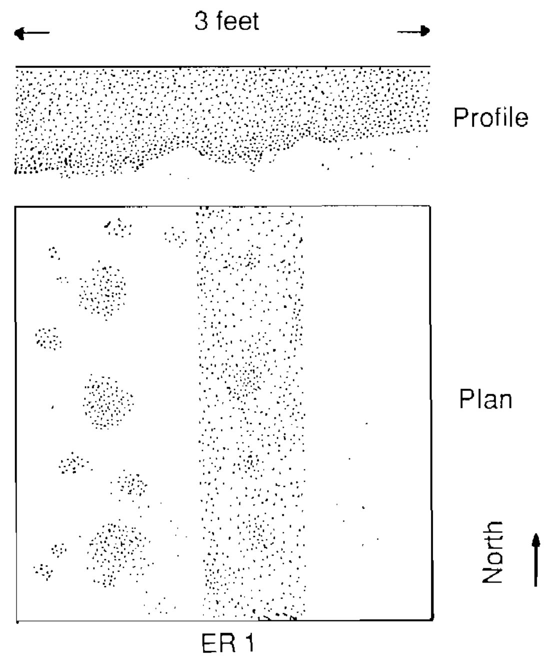




Figure 46

**White Marsh Branch Site, ER 1-2-4**

At the beginning of the project, while surveying the southern alignment (dashed line), three test squares were sunk along the north side of White Marsh Branch. The only features in these tests were well-defined linear stains. These features had three components: a row of rootmolds, a superficial brown linear strip of topsoil, and rootmolds under the linear strip. Additional tests are shown in figures 21, 53, 54.

Previous agribusiness site investigations chronicled in this series include an implement factory (Coleman, Cunningham, Catts and Custer 1985), a market hamlet (Cavallo, Friedlander and Bowers 1988), a feed mill (O'Connor, Cunningham, Coleman, and Brockenbrough 1985), and two canning factories (Coleman, Hoseth, Custer, and Jaggers 1988; Heite 1990).

Since agricultural fields have traditionally produced most of the data for survey archæology, interpretation of their agricultural component requires nothing but a re-examination of data that already is being collected, but has been under-evaluated.

Such events as mechanization, chemical fertilization, substitution of row crops for orchards, or introduction of the use of marl, should be reflected in the soil record. Poor husbandry and attempts to recover from its effects, should be dramatically visible in the soil in the form of deep erosion deposits at field edges.

These events, in turn, are the stuff of archæological interpretation, wherein the archæologist can provide insights independent of the documents. Schuyler (1977) demonstrates that this emic/etic duality is inherent in the *raison d'etre* of archæological evidence when applied to historical conclusions.

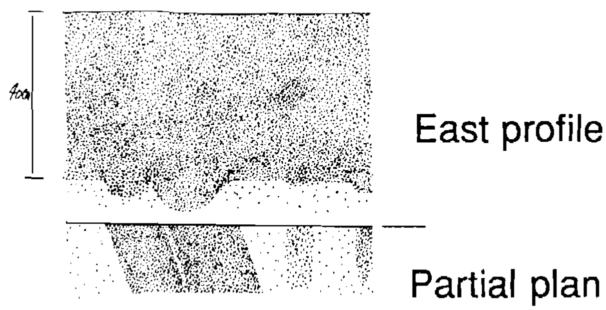



Figure 47

**Shovel plow scar**

ER 113 revealed evidence for several passes of a shovel plow and harrows See photo, Plate 13, page 76.

In spite of its potential, agricultural historians have not taken advantage of the archæological method as a source for primary data. Everything written about Delaware agricultural history to date has been derived from documentary sources, without reference to input from archæology (e.g. Passmore 1978). Since archæology has not been ready to provide the data, this lack of communication is not a surprising state of affairs.

Some potential agricultural data has been noted and dismissed as mere annoyance. Plow scars, which obscure the outlines of underlying features, traditionally are dismissed unrecorded, unless they have damaged another feature, in which case they are recorded, labelled as "intrusions" and *then* dismissed. During the present project, it was decided that plowscars would not be ignored, in the hope that information might be wrung from them (FIGURES 46 AND 47).

Scattered bits of historic pottery and glass found in cultivated fields are traditionally dismissed as manuring spread, unworthy of further analysis.

Drainage ditches, too large to ignore, are traditionally recorded, but are analysed only as part of a domestic or industrial context, as landmarks defining site boundaries.

Planting holes, post holes, and burned soil patches, are interpreted when they contribute to understanding a toft, but seldom have been analysed in relation to the croft.

Pieces of farm implements likewise are traditionally regarded as isolated finds, out of context, even when they are recovered from their proper archæological context: the plowzone of the field itself, where they were made to be used and ultimately were lost.

It can be argued that, of all the artifacts found in plowzones, only agricultural artifacts are in their original contexts. By the same argument, any agricultural artifact found in the plowzone should be regarded as having come from its original, readily definable, stratum, which happens to be the most recent plowzone in most sites. By the same argument, archæological attention can be profitably drawn to the "intrusions" heretofore dismissed as archæologically irrelevant.

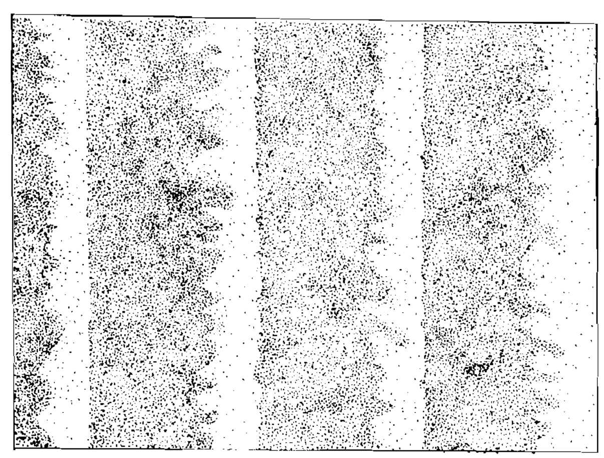


Figure 48

**Mouldboard plow scars**

During Gradall stripping of the west part of the White Marsh site (Figure 44, page 77), this clear pattern of plowscars was found in ER 124. Made by a modern gang plow, the scars are uniformly deep and evenly spaced. The smooth edge to the left is the polished mouldboard edge (not to scale).

If only because they exist, agricultural remains must be interpreted, since every archæologist is duty-bound to interpret everything he or she finds on a site, whether or not the finds happen to inform the researcher's own subspecialty or personal research biases.

European researchers, on the other hand, have devoted considerable attention to the field as an archæological site category. A journal, *Tools and Tillage*, published by a secretariat of the Danish Academy of Sciences, is devoted entirely to agricultural practices, implements, and their effects on the archæological record.

In an experimental archæological study of Danish plow furrow profiles, Grith Lerche (1986) has shown that it is possible to determine not only the design of the plow, but the direction it was travelling and other details of the tiller's craft. This approach was applied in the present project, with informative results.

## Evidence in the Project Area

A stated purpose of this study was to examine the agricultural data quality from this project area, to determine exactly what might be learned about agriculture by analysing this kind of archæological data in the future.

In the project area, former agricultural fields were partly stripped by machine, allowing the investigator to view relatively large swaths of subsoil. These areas, stretching across the former Denney farm from the White Marsh Branch site to Route 13, had very different agricultural histories, even though all the test sites were mapped as Sassafras soil with areas of less desirable soil.

The White Marsh field (FIGURES 21, 53, 54, PLATE 14) is broad, open, and high, sandy and well drained. The trailer sales lot contains more clay, lies low, and was in part wetlands before being artificially drained (FIGURES 12, 49, 50, 51, PLATE 5).

The two fields exhibited stark contrasts in the archæology of their husbandry. Whereas White Marsh probably has always been broadly cultivated as a single field or orchard, the trailer lot was cut up with little planting holes, ditches, and short garden rows. This less desirable agricultural land at different times has been used for gardening and for agricultural support activities which were not carried out on the more desirable cropland.

The trailer sales lot, with all its variety, was more interesting to the archæologist, even though the relatively boring sameness of White Marsh certainly was more desirable to generations of farmers.

## Drainage Works in the Project Area

If any theme runs through the history of Delaware agriculture, it is ditching. Few parts of the state are without ditches, and few farms could have prospered without them.

High organic content and mineral richness attracted farmers to wetland soils. The earliest settlers had drained Delaware salt marshes, or meadows, to create hay fields and pastures. Peaty freshwater bog soils, a natural compost, were recognized for their properties as soil conditioners, and were sometimes mined.

Marsh farming practices had nothing to do with the scientific agriculture movement, but rather were rooted in the fenland drainage practices of England and the Netherlands, where techniques had been developed over centuries of lowland farming. Marsh meadows finally fell into disuse early in the present century.

Drainage of freshwater wetlands, like those in the project area, accelerated during recent generations. Abetted by publicly-funded programs, farmers aggressively claimed freshwater wetlands for farming, until public policy reversed during the past decade, and the freshwater wetlands became valuable resources to be husbanded. Now, instead of draining every possible wet tract, public policy mandates preservation or replacement of these resources. Whereas previous generations had sought to remove water from the land, we build detention basins to allow the soil to absorb the water.

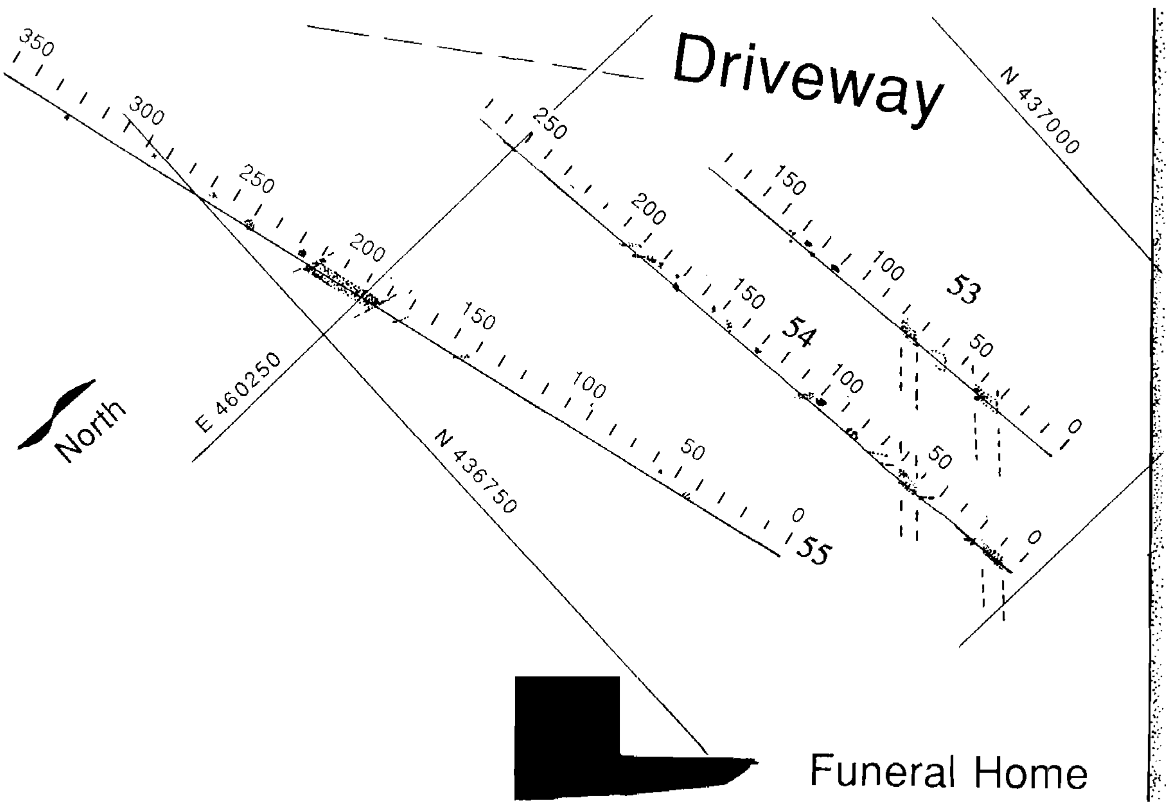



Figure 49

**Machine-cut trenches in the trailer sales site**

Adjacent to the old state road, now Route 13, is a low-lying field, mapped nominally as Sassafras, which proved to be low and poorly-drained. Three machine-cut trenches across the field revealed a number of features, which are shown on the following three pages. The scales on this plan are the key to locations in the trenches, in feet.

The most imposing agricultural features of the project area are the ditches. Ditches on this site were recorded by three different means: by documentation, by field observation, and by excavation.

White Marsh Ditch (K-6487) was identified in the documentary research when the stream name changed from "branch" as late as 1828 to "ditch" in later documents. Physical evidence for the ditching was not readily apparent during the initial walkover survey, nor were incorporation papers for the ditch company discovered under that name. The tributary ditch system, however, can easily be seen along the perimeters of the fields south of the project area, where virtually all hedgerows are drainage channels as well (FIGURES 15, 21).

The ditch draining Simon's Savannah (K-6488, FIGURES 2, 15, 16, PLATE 10), which defined the Denney home lot and today delineates the boundary of the landscaped DelTech campus, is a prominent feature. In places, the ditch is open as much as six feet deep, with spoil piled as high next to it. Without documentation, this ditch line is difficult to date. However, it appears to have been dug in two stages.

Figure 50

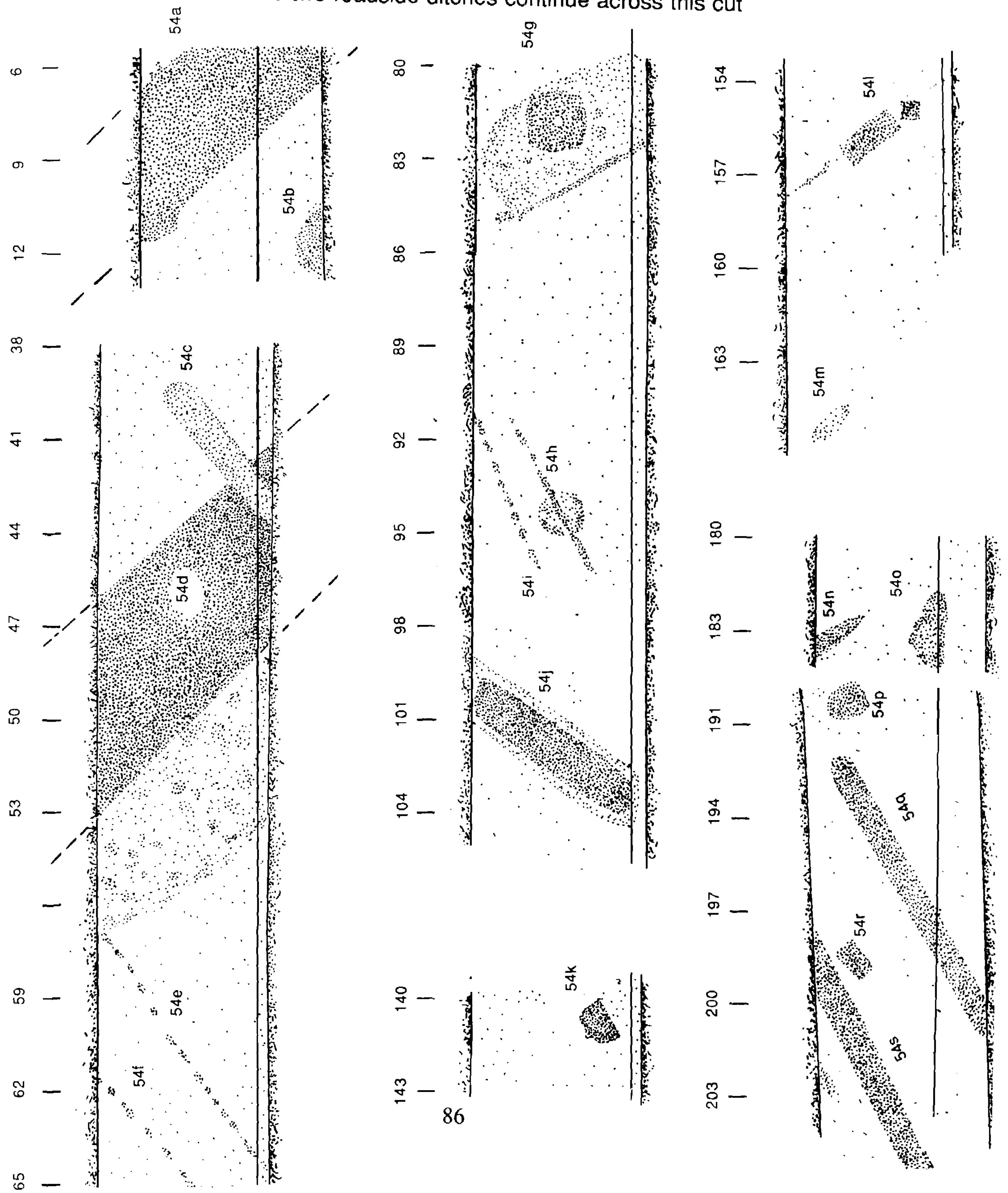
## Plans and profiles in the machine cut, ER 53

Two ditches parallel to the state road indicate an early attempt to drain the field. Layers of clay sediment in the bottoms of the ditches testify to standing water. The field is dotted with apparently random holes and linear stains, but few artifacts were found.

Figure 51

**Plans of the machine cut, ER 54**

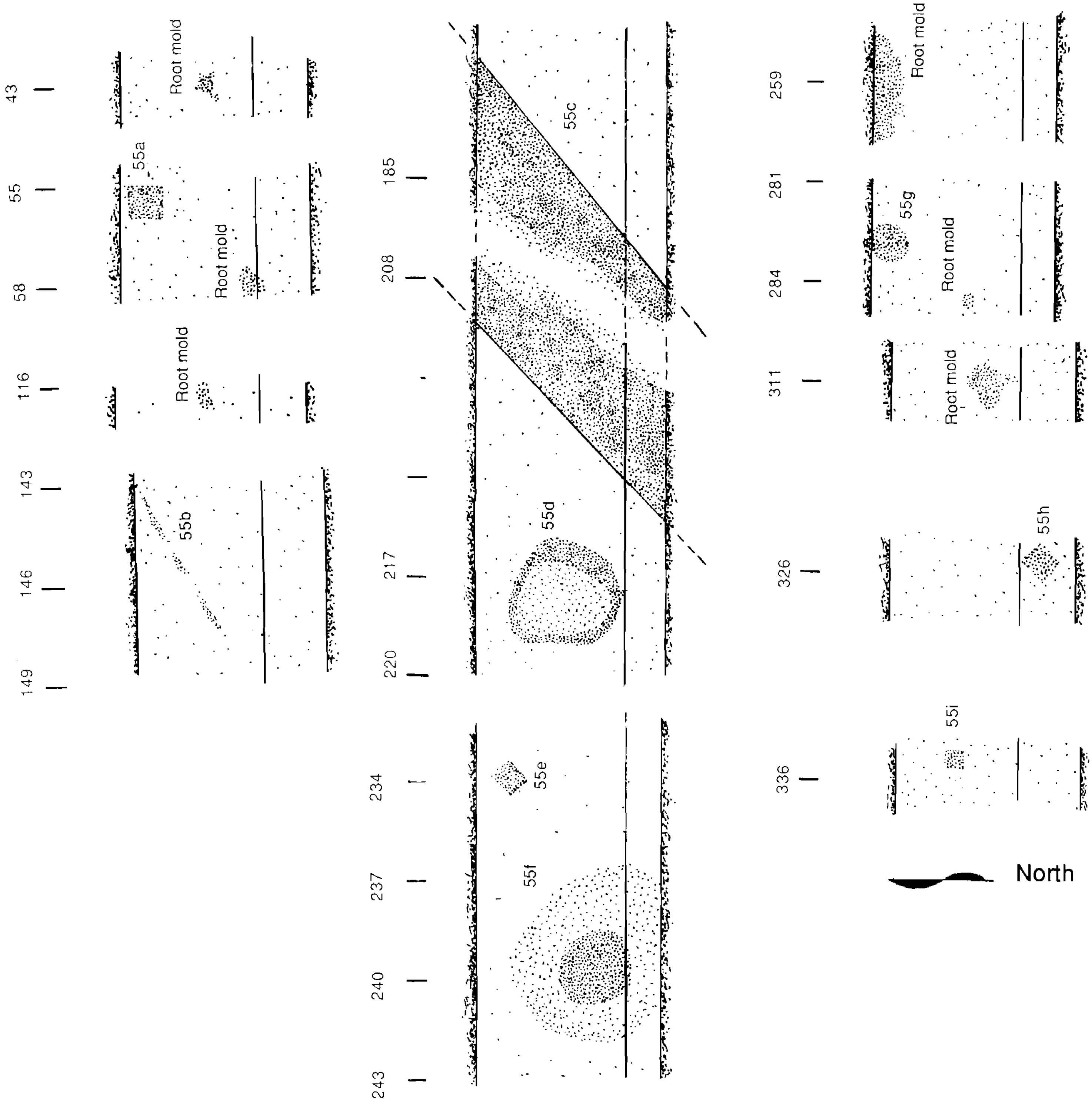
The two roadside ditches continue across this cut



## Figure 52

**Plans of the machine cut, ER 55**

Feature 55c is probably a modern disposal trench associated with the trailer sales. Note the square planting holes and one large post hole in post mold.



The first stage, west of the college campus proper, lies in a grown-up hedgerow. This is apparently a hand-dug ditch that has been maintained over a long period and has been allowed to grow up in trees. It may originally have been an enhanced natural drain, since it appears on some of the earliest plots as a drain.

The section of this ditch that drains the savannah may be much more recent. The large size of the cut, and the uniform, backdirt pile indicates that machinery may have been used to dig this section of the ditch, and relatively recently.

This conclusion is borne out by the 1937-1938 Highway Department ærial photograph (PLATE 3, PAGE 11), which shows the entire corner cultivated, with no ditch from the bay/basin feature.

Two ditches were discovered parallel to U. S. 13, on the extreme eastern end of the project area, during the machine stripping. These ditches had been dug, abandoned, backfilled, forgotten, and finally plowed over (FIGURES 50, 51).

They were hand-dug ditches, about two feet deep, dug through the clay hardpan and into the sand below. Water had been allowed to stand in these ditches, which apparently did not drain, even though they might have facilitated drainage into the sandy subsoil below.

Because these ditches were parallel and close together, we may assume that they are part of the same effort, but they do not appear to have been contemporary. Indeed, the likeliest explanation is that one replaced the other sometime in the early part of the nineteenth century.

After these two ditches had been abandoned and backfilled, there was another attempt to drain this field, which succeeded. The area became arable and was cultivated, the plow scars running east-west across the old ditch fill. Today the tract continues to experience water problems, alternating between a sticky morass and adobe-like hardness.

A drain tile, recovered from ER 59 (FIGURES 18, 19, 20), is an example of the most expensive method for reclaiming wet fields. This particular tile could have been installed as recently as the middle of the present century, even though it was laid in a hand-dug ditch. This tile has bell couplings and a surface glaze, distinguishing it from earlier tiles, which most frequently were unglazed.

This particular tile did not function very well, for it was filled with clay when it was dug up. Clogging was only one of the problems that beset tiled fields; crushing was another hazard. There were ways to avoid both hazards, but they added to the cost.

Delaware farmers tiled their fields frequently with locally-produced tiles. Bay/basin features, which frequently are ringed by high ridges, are particularly susceptible to tile drainage. In the present instance, the tile was buried five feet deep, and was aimed directly at the bend in the ditch draining Simon's Savannah.

### PLOW SCARS AND PLANTING HOLES

Anyone who has read a seed packet is aware that each cultivated plant species requires individualized spacing, planting depth, and cultivation practices. Through time, these practices have changed in response to new technologies and changing methods of cultivation. Small grains, formerly broadcast, are now planted in rows.

Vineyards appear as rows of rich, deep, soil punctuated and terminated by the posts that supported trellis structures.

Orchards typically are a grid of trees planted in rows separated by driveways. Nurseries have a distinctive footprint, since a sizable root ball of soil is removed with each plant. An abandoned nursery resembles nothing so much as a bombed battlefield pockmarked with unfilled craters and wooded with partial rows of overgrown ornamental shrub species.

Smaller-scale crops, while leaving distinctive imprints, may not be as spectacularly distinguishable as these examples. What will distinguish a soybean crop from a corn crop in the archæological record? How would one determine which crop came first? Who cares?

## Figure 53

**Plan of the machine cut, ER 51**

In these test trenches across the broad and well-drained White Marsh site open field, a pattern of parallel scars testifies to modern gang-plow equipment. The scars are flat-bottomed, indicating the use of a mouldboard plow. In cases where the Gradall cut away the plowscar itself, note that linear patterns of rootmolds continue to delineate the planting line.

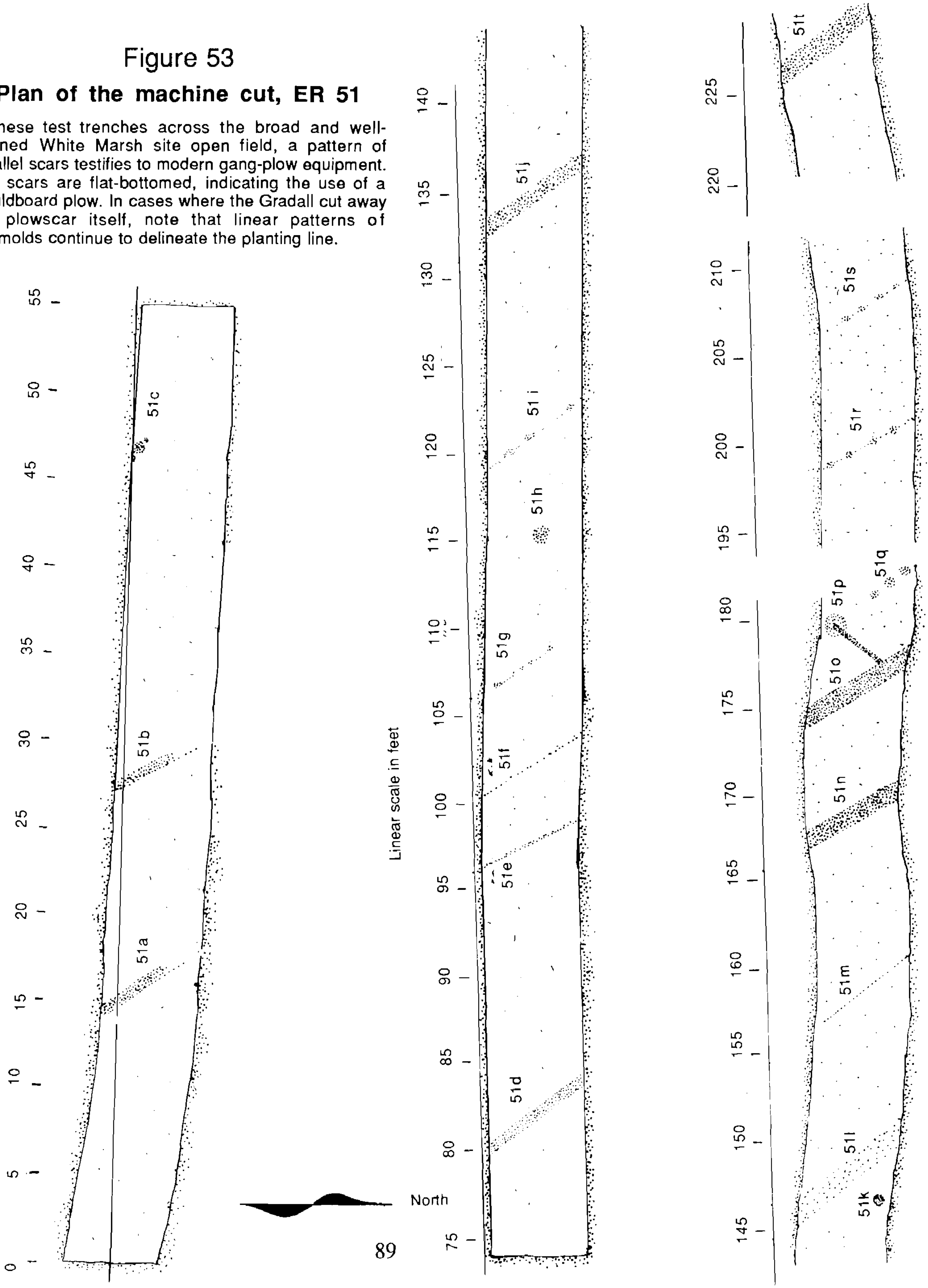
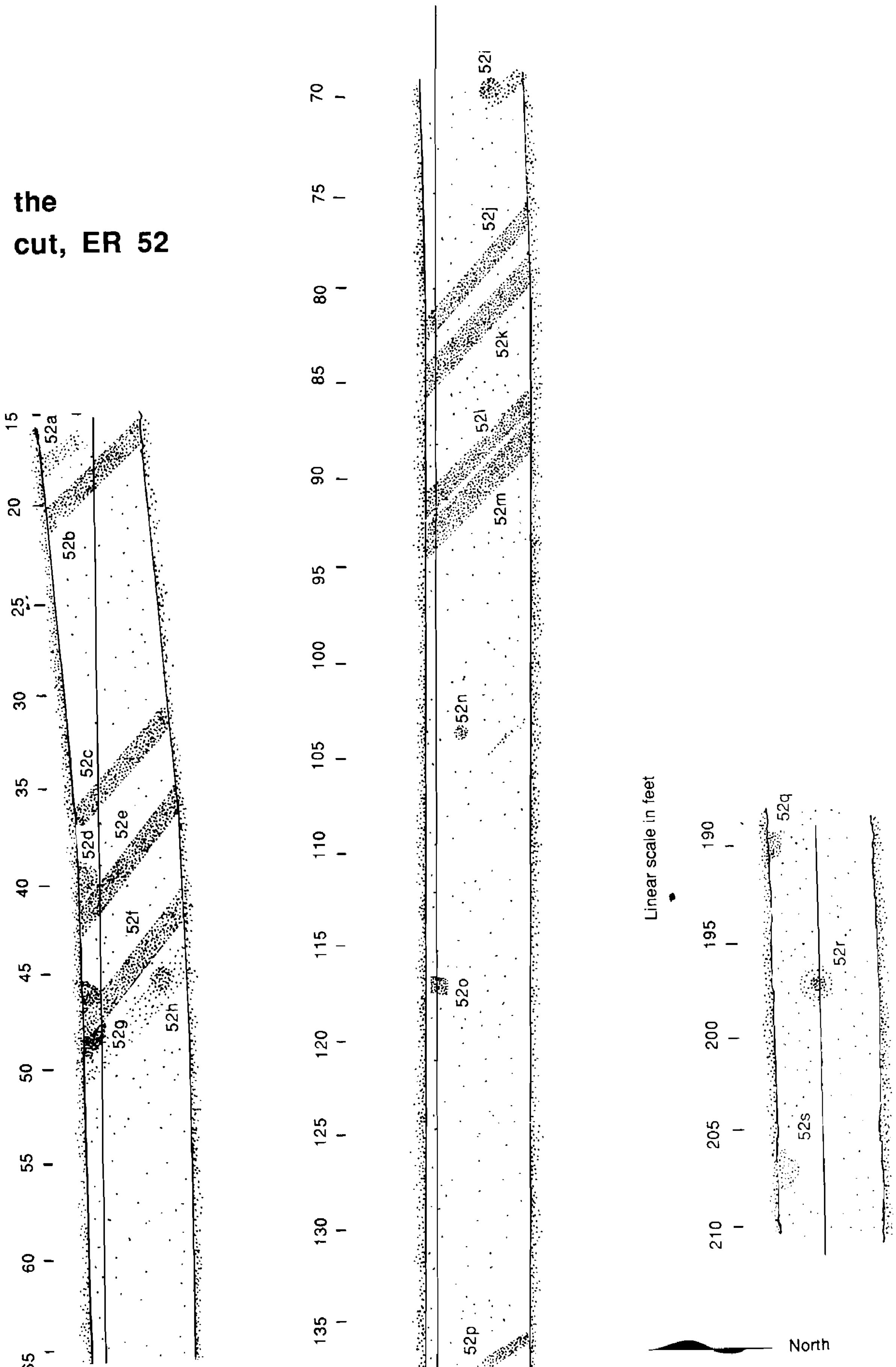


Figure 54
**Plan of the machine cut, ER 52**



Only the farmer really has any reason to care about which crop is planted on which field, year-to-year, even though crop rotation practices probably could be reconstructed from evidence in the ground. Archæologists and historians of agriculture are more likely to want to know about any damage the farmer did to the soil, or any change in husbandry practice that might have had a long-term economic or social impact.

Far from being a single type of feature, plow scars come in a variety of types, reflecting a variety of origins. Some of the features labelled "plow scars" are not, in fact, scars left by a plowshare cutting the subsoil.

Pointed, or V-shaped, plow scars may not have been made by plows at all, but by harrows or cultivators (Lerche 1981: 114), especially if they cross the plow furrows at right angles. Spike harrows, and more recently disk harrows, are used to smooth fields after plowing.

A shovel plow (FIGURE 55, PAGE 92), such as were favored through much of the South into the present century, scratched a shallow round groove across the ground (PLATE 13, FIGURE 47), whereas a mouldboard plow cuts and lifts a block of the soil and turns it over (FIGURE 56).

Mouldboard plows have been used in European agriculture at least since the middle ages, but they have not been uniformly adopted in America. In some parts of America, notably Tidewater Virginia during the eighteenth century, all plows were disdained as effete by farmers who spaded and hoed their fields.

Shovel plows were commonly used in some areas until the Civil War era, by which time more progressive farmers had adopted the mouldboard exclusively (Hurt 1985). Shovel plows had no mouldboard, but operated by a scratching rather than a cutting action. The Delaware Agricultural Museum holds several shovel plows from Delaware. The museum also has several chisel-type cultivators.

A shovel plow should not, however, be regarded as an exclusively archaic tool. The 1908 Sears, Roebuck catalogue advertised one-horse, single-bottom, shovel plows for $1.54.

A scar left by a mouldboard plow is a flat-bottomed feature about ten to fourteen inches wide. At the edge of the plowscar is a little row of subsoil clods mixed with the topsoil (FIGURE 46).

Lerche (1986) demonstrated in field experiments that mouldboard plows leave a polished face on loamy soil, which can be recovered even after centuries, given correct soil conditions (FIGURE 48).

At the White Marsh site there was a correlation between plowscars and plants. Immediately under each plowscar was a linear arrangement of rootmolds left by the plants that grew in the plowed furrow. If the plowscar has been scraped away, only the line of rootmolds will survive (FIGURE 53).

One should not assume from this evidence that crops are planted immediately on top of plow scars. Instead, it has been suggested that roots follow the polished edge of the plow furrow to the bottom, thence into the subsoil.

On some shovel holes in the trailer sales site, notably ER54p and ER54k (FIGURES 50, 51, 52), where root molds were apparent on the sides of shovel holes opposite the polished flat faces. It is therefore possible that the rootmold pattern is related to the polishing effect of implements.

Since plows have been growing progressively bigger and deeper, evidence of earlier cultivation should be expected to have been wiped out by later plowing. Earlier cultivation practices, therefore, should be sought in abandoned fields, at the bottoms of recent alluvial layers, or in other places where modern deep plows have not reached. This is how the Danes have located Viking period field cultivation features under sand dune layers, and how shovel plow marks survived at White Marsh under slope wash (PLATE 13, PAGE 76).

Keeping in mind the fact that features called "plow scars" are not all plow scars, the linear features found on the White Marsh and trailer sale sites fell into several catergories.

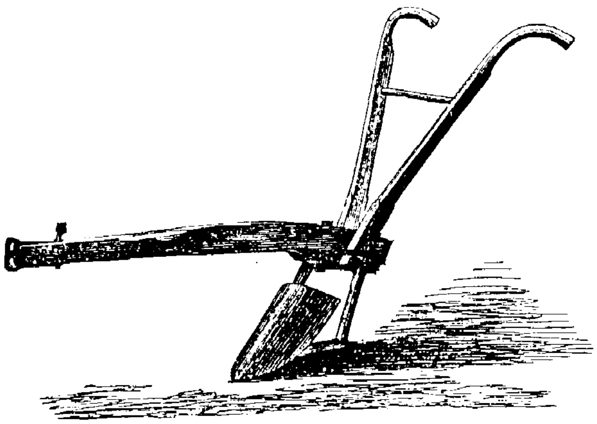


Figure 55

**Shovel Plow**

This illustration from *The Farmer's Book,* 1868, shows the type of plow that creates round-bottomed single cuts.

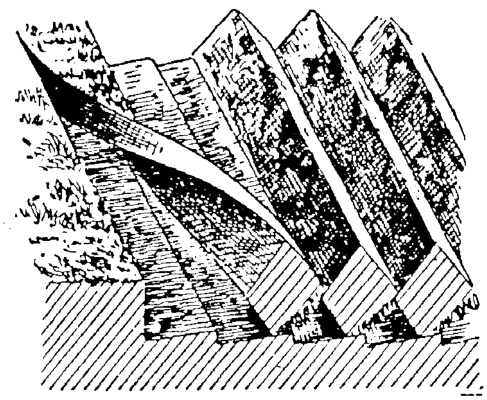
First were the broad, flat scars of a large mouldboard plow that crossed the White Marsh site in regular order, north to south (FIGURES 46, 53, 54). These scars generally were about ten to fourteen inches wide and penetrated the subsoil seldom more than an inch or two. The scars were more prominent on the more elevated parts of the site, and appeared to be regularly spaced.

Regular spacing and prominence on the higher locations may be taken to indicate that all these scars belong to a single season's cultivation, when conditions permitted the plow to bite more deeply than usual.

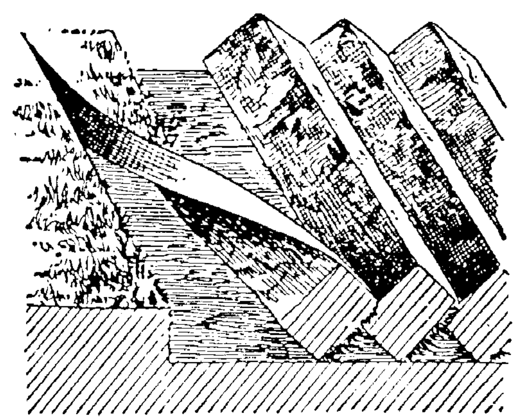
One of these conditions could have been soil loss from an episode of sheet erosion on the hilltops. If erosion lowered the elevation of the field an inch, the plow would bite to its prescribed depth, taking an inch of the subsoil, in turn creating conditions favorable to more erosion.

This appears to be precisely what happened at White Marsh, since there were other, nearby, lines of rootmolds, possibly left by earlier crops.

In addtion to the linear features from row crops (ER 51 a, b, d, e, f, g, i, j, l, m, n, o, q, r, s, t, and ER 52 a, b, c, e, f, h, j, k, l, m, and p, FIGURES 53, 54), the White Marsh site contains scattered burned features that probably are associated with an earlier orchard phase (ER 52 d, g, h,.i, and s). The field also contained a number of postmold-like features, consisting of round or square soil marks containing soil resembling the topsoil (51 c, k, p, 52 n, and o). It is difficult to call these features "postmolds," since they were seldom, if ever, associated with postholes.



Crested Furrow.



Rectangular Furrow.

Figure 56

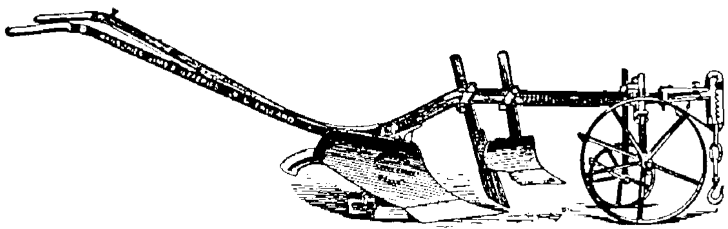
**Furrow profiles**

These two illustrations from the eleventh edition of the *Encyclopædia Britannica* illustrate the difference between the scars produced by two of the many possible different kinds of furrows

Figure 57

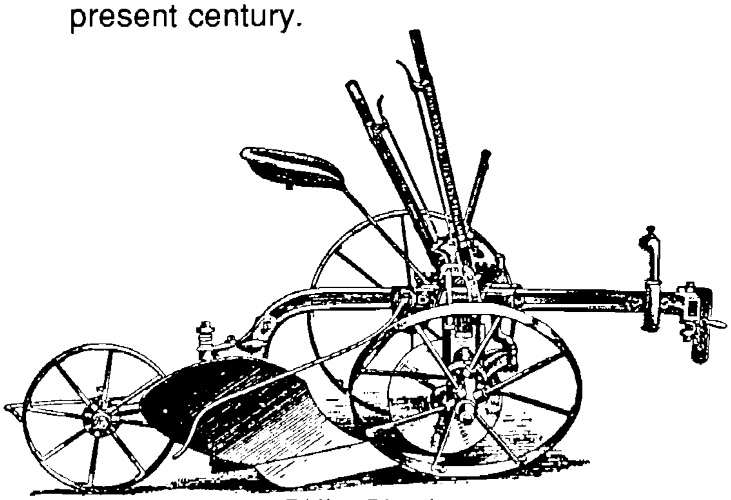
**Varieties of plows**

These illustrations from the eleventh edition of the *Encyclopædia Britannica* illustrate a few of the major plow types available in Britain at the turn of the present century.



Digging Plough.

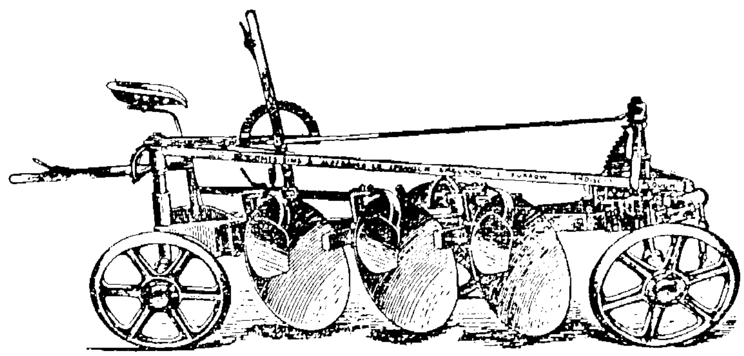
The digging plow, above, was used to bring up the subsoil.



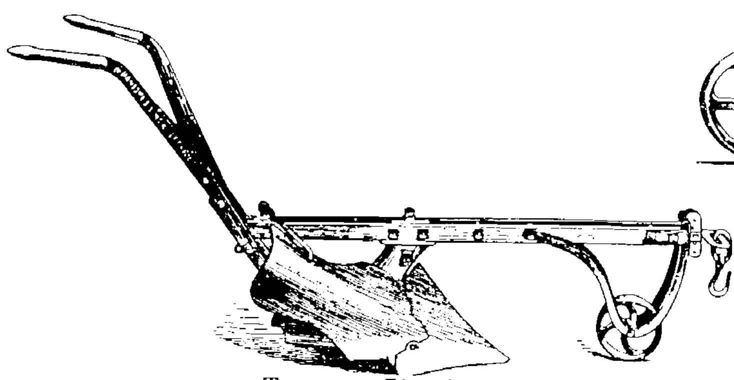
Riding Plough.

Riding plows, such as the one at left, were introduced for cultivating large fields. The two larger wheels ride on the land, and the smaller one rides in the furrow to support the share.

Multiple disk plows, such as the one below, substituted a disk for a share.



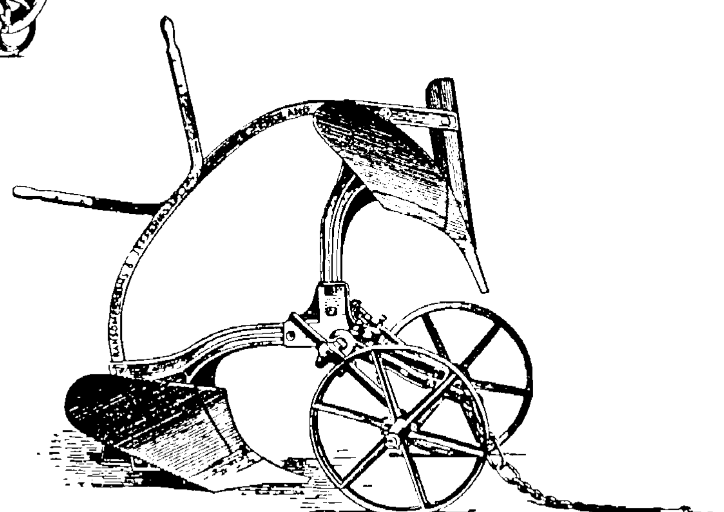
Multiple Disk Plough.



Turnwrest Plough.

The turnwrest plow, above, was designed to turn a high crested furrow.

Balance plows, like the one at right, would allow each furrow to be aligned with the mouldboard on the same side, even though the machine is going back and forth across the field.



Balance Plough.

In the wooded portion of the White Marsh site, an abandoned section of the field contains marks from shovel plows. Chemical analysis in this area disclosed a lack of evidence for soil amendment.

Other marks clearly are tree planting holes, with a round hole surrounded by root molds (ER 51 h, 52 r), probably from the orchard period.

It is impossible in such narrow trenches to make out patterns of such molds that might betray the presence of an orchard. The large number of burned areas could be explained by the burning of tree trimmings or smudge fires built to combat frosts. Disease control practices required that blighted branches be burned as quickly as possible to prevent the escape of spores.

## PLOW DEPTH AND SUBSOILING

A plowman's doctrine holds that "subsoiling," driving the plow into the subsoil, will increase fertility by bringing to the surface valuable minerals from below. Subsoil plows frequently strike buried foundations and trash pits that had lain undetected below the reach of smaller plows.

The depth of a plow is measured by the depth of the mouldboard, which carries the soil up and turns it over. This depth is twice the actual depth of penetration, but farmers are sometimes unwilling to accept this premise, since they evaluate their plowing while the furrows still lie open. After the field has been levelled by harrows, the true depth of the plowing becomes evident. Modern plows seldom create a plowzone deeper than nine to twelve inches, and shovel plows stayed in the top three inches of the soil. The many different plows used for different purposes through the years (FIGURE 57) should each leave distinctive marks with potential for intepreting historic agricultural practices.

In addition to the damage it does to the cultural resource below, plowing encourages a gradual reshaping of fields through increased sheet erosion and alluvial infilling of low places. This loss of relief can destroy surface indications of roads, graveyards, foundations, fortifications, wells, or other earthworks.

## FERTILIZATION

Agricultural practices are sometimes the stuff of legend. We no longer put a dead fish in the bottom of each corn hill, and we have no archæological evidence that prehistoric people in this area did so, either. We do have evidence for other soil supplements, some just as noisome as dead fish.

In the argot of early farm literature, the term "manure" was not confined to "excrementitious animal substances," but included any material that could be spread on fields, including tanyard and slaughterhouse offal, hair, feathers, rags, and horn. The noted English chemist Sir Humphry Davy recommeded spreading all these materials on fields (Pennsylvania Agricultural Society 1824:261). He also noted the value of gaseous ammonia and carbon dioxide as fertilizers, but could suggest no way then available to apply them to the soil.

Nineteenth-century farmers were admonished by the experts to use barnyard manure, pigeon droppings, and even the contents of their own privies. Lime, derived from calcined oyster shells or limestone, was a major component of any soil improvement program.

Joseph Harris, in his book *Talks on Manures* (1878:10), described the practices of a thrifty farmer: "He cultivates very thoroughly, plants in hills, and puts a handful of ashes, plaster, and hen-manure on the hill." An entire chapter of the book was devoted to swamp muck or peat composted with manure.

Street sweepings were so valuable that municipalities charged fees for the privilege of cleaning the streets; one Wilmington manure collector was Jacob Broom, a signer of the United States Constitution (Heite 1987: 63). Collectors were constrained to pick up material only after it had lain 48 hours, to give adjacent homeowners ample opportunity to claim it.

Night soil from urban privies in Philadelphia and Baltimore was sold as a raw material for fertilizer. It was mixed with street sweepings and garbage to produce a product called poudrette. Addition of gypsum and charcoal was expected to make the product less objectionable and more useful (Roberts and Barrett 1984).

In the project area, there was a readily identified artifact category best called "manuring spread," consisting of small bits of redeposited domestic ceramics, brick chips, coal, and other domestic artifacts in extremely fragmentary form.

Distribution of this artifact category was congruent with certain agriculturally undesirable soil characteristics.

Such materials were absent from the Sassafras soils on the White Marsh Branch site field, but were found in the poorly-drained Pocomoke soil at the north end of the field (ER 21, 23, and 38). On the well-drained soil, only one lump of coal was found. Prehistoric artifacts, on the other hand, were scattered throughout the well-drained Sassafras part of the field.

In this case, the two classes of artifacts represent exactly opposite indications of habitability. The prehistoric artifacts on this field are primary deposits, and may be taken to represent human occupation and use of the locus; the secondary deposits of historic artifacts in the same field indicate less useful land that the farmer was trying to make useful.

On the trailer sales site (7K-C-392), where one is struck by the number of man-made features, the lack of artifacts is equally striking. A visiting archæologist remarked that the Gradall's spoil piles, devoid of artifacts, simply did not *look* like spoil piles from a historic site. Yet there were dozens of features on the site, within a hundred yards of known early tofts.

Notably absent from this field were the little bits of domestic trash, or the large deposits of domestic trash that would have indicated worthless land near a toft. The little bits would have indicated attempts at manuring, while large deposits would have indicated that the site was useful only as a dump.

Instead, the trailer sales site chronicled centuries of coping with wetness. While the field is mapped as Sassafras in the county soil book, it is anything but well drained. The surrounding poorly-drained types, Fallsington and Pocomoke, more accurately describe the field. When this was a separate holding, early in the nineteenth century, the toft was located on well-drained land next to the natural water hole of Simon's Savannah.

This was apparently the period when two ditches were dug parallel to the state road in an attempt to drain the site. It was then a small holding, not part of the adjacent Denney farm, and was not manured.

Fifty years ago, the trailer sale area was under cultivation as part of the Denney farm, according to the Highway Department ærial photograph, but the large drainage ditch had not yet been cut. This ditch (K-6488) apparently was dug by the Zimmerman family, progressive farmers who bought the farm in 1944. It was in place by 1956, when the USGS showed it on the topographic quadrangle.

The archæological record on this field consists of many diverse features, rather than the uniform plowscar pattern that was found at White Marsh. There are small trenches and planting holes, root molds, and activity areas that appear to have been unrelated to crops. Across all these features is a pattern of modern-style plowscars running perpendicular to the highway, which could not have been made before the field was successfully drained.

On the Ford farm, where no stripping was carried out, the same pattern existed. Well-drained high fields were devoid of historic sherds, but the artifact count rose with the clay content of the soil.

Fertilization schemes attempt to change one or more of three properties of soil: chemistry, physical characteristics, and organic content. Chemical analysis can detect evidence of all three types of soil alteration (Custer, Coleman, Catts, and Cunningham 1986).

## SOIL SAMPLES
## FROM WHITE MARSH, ATHLETIC FIELD, AND BOYER TOFT SITES

| Lab Sample | Artifact Content | Excavation Register | pH | *Elements in pounds per acre:* P | K | Mg | Ca | Mn | Zinc |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Historic | 21 | 5.8 | 176 | 100 | 108 | 765 | 14.0 | 1.9 |
| 2 | | 22 | 5.5 | 212 | 47 | 69 | 534 | 20.9 | 2.0 |
| 3 | Historic | 23 | 5.6 | 185 | 92 | 86 | 623 | 30.8 | 2.3 |
| 4 | Prehistoric | 24 | 5.2 | 167 | 78 | 65 | 445 | 17.7 | 1.8 |
| 5 | | 25 | 5.3 | 166 | 97 | 73 | 516 | 21.3 | 2.5 |
| 6 | Prehistoric | 26 | 5.0 | 119 | 103 | 86 | 552 | 18.2 | 3.1 |
| 7 | | 27 | 5.4 | 113 | 187 | 134 | 783 | 27.1 | 5.3 |
| 8 | | 28 | 5.4 | 105 | 117 | 99 | 730 | 18.9 | 2.3 |
| 9 | | 29 | 5.4 | 102 | 100 | 97 | 605 | 12.6 | 2.0 |
| 10 | | 30 | 5.5 | 62 | 103 | 123 | 659 | 14.6 | 2.4 |
| 11 | Prehistoric | 31 | 5.7 | 129 | 181 | 136 | 997 | 18.1 | 4.2 |
| 12 | | 32 | 5.3 | 102 | 97 | 99 | 659 | 13.3 | 1.7 |
| 13 | Prehistoric | 33 | 5.3 | 105 | 117 | 138 | 801 | 10.8 | 2.7 |
| 14 | Historic | 35 | 5.4 | 70 | 114 | 121 | 676 | 5.2 | 1.0 |
| 15 | | 36 | 5.5 | 78 | 181 | 112 | 659 | 8.0 | 1.8 |
| 16 | Prehistoric | 37 | 5.1 | 123 | 128 | 108 | 730 | 10.7 | 2.2 |
| 17 | Prehistoric | 34 | 5.2 | 35 | 103 | 132 | 641 | 4.6 | 0.9 |
| 18 | | 38 | 5.1 | 204 | 61 | 69 | 516 | 10.1 | 2.5 |
| 19 | | 39 | 5.6 | 74 | 53 | 73 | 570 | 6.2 | 1.4 |
| 20 | Prehistoric | 40 | 4.3 | 76 | 61 | 28 | 214 | 5.6 | 2.4 |
| 21 | Prehistoric | 42 | 5.5 | 91 | 95 | 102 | 659 | 5.2 | 1.5 |
| 22 | both | 43 | 4.4 | 60 | 33 | 30 | 160 | 4.1 | 1.8 |
| 23 | both | 44 | 4.2 | 78 | 39 | 43 | 249 | 4.2 | 2.5 |
| 24 | Prehistoric | 45 | 4.2 | 24 | 28 | 39 | 249 | 4.6 | 2.4 |
| 25 | | 46 | 4.5 | 46 | 17 | 35 | 142 | 2.7 | 2.8 |
| 26 | Prehistoric | 47 | 4.5 | 74 | 19 | 28 | 160 | 2.9 | 2.5 |
| 27 | Prehistoric | 48 | 4.8 | 56 | 14 | 24 | 267 | 4.8 | 2.3 |
| 28 | Prehistoric | 49 | 4.2 | 68 | 33 | 32 | 214 | 5.0 | 2.8 |
| 29 | Historic | 50 | 5.4 | 147 | 228 | 244 | 1460 | 13.1 | 3.1 |
| 30 | Historic | 53c | 5.5 | 33 | 78 | 145 | 979 | 28.0 | 1.3 |
| 31 | Historic | 55c | 6.4 | 64 | 114 | 324 | 1371 | 152.0 | 6.1 |
| 32 | Historic | 53b | 5.7 | 33 | 50 | 240 | 1139 | 25.2 | 4.0 |

Soil chemical analysis is a useful tool for farmers as well as for archæologists. Since the early nineteenth century, farmers have been concerned with the chemical contents of their soils. In response to these needs, the nation's agricultural colleges developed systems for delivering chemical analyses to farmers.

Archæologists more recently have been using agricultural chemistry as a tool to trace human activities within sites. The results have been startling, allowing delineation of human activity areas that have otherwise left no trace whatever.

Analyses summarized in the table on the facing page have brought the process full circle. Soils from two agricultural sections of the project area were analyzed in the agricultural soil laboratory at the University of Delaware, so that archæologists might seek evidence of agriculturists' impact on the most important agricultural artifact, the soil itself.

Laboratory samples 1 to 20 are from shovel test pits in the agricultural field that delimits the eastern side of the White Marsh site. Samples 21 to 28 are from the wooded part of the site, in the west, on the edge of a relict field boundary. Sample 29 is from the DelTech athletic field, where grounds maintenance has been intensive. The last three tests on the list are from the trailer sale lot portion of the Boyer Toft.

At White Marsh, soil samples taken in the recently cultivated field showed high levels of agriculturally-important chemicals (ER 21-40). The old field area, which had not been cultivated in modern times (ER 43-49), showed a lack of chemical amendments. The sample from the athletic field, on the other hand, showed very large quantities, particularly of calcium, which should be expected in a limed field.

It clearly is possible to identify the direct material remains of scientific agriculture by studying croft archæology. Since cultivation was the principal activity of the farmer, changes in cultivation should be reflected in the archæological record. At a minimum, it should be possible to determine the presence or absence of scientific agriculture.

Plate 16

Blueberry Hill, 7K-C-107, from the railroad, looking northeast. The original test unit was placed near the center of this picture. Even in this environment, some agricultural remains were detected in the remnant of the site, including at least two periods of plowscars.